

901.04 STONE FOR SLOPES. Stone for slopes shall conform to M 43, size number 1 omitting T 11. The stone shall also conform to the quality requirements specified in 901.03.

901.05 STONE FOR GABIONS. Stone for gabions shall conform to the quality requirements specified in 901.03 and the following, except that the loss by sodium sulfate shall not be greater than 12 percent:

DEPTH OF BASKET in.	SIZE OF INDIVIDUAL PIECES * in.
6	3 – 6
9	4 – 7
12	4 – 7
18	4 – 7
36	4 – 12

*Size of pieces will be determined visually.

SECTION 902 — PORTLAND CEMENT CONCRETE AND RELATED PRODUCTS

902.01 STORAGE. Storage of materials shall conform to the Contract Documents and as directed by the Engineer.

902.02 CERTIFICATION OF PORTLAND CEMENT AND BLENDED HYDRAULIC CEMENT. The manufacturer shall furnish certification as specified in TC-1.02. The certification shall also include:

- (a) The mill shall report its quality control procedures, and submit a new report whenever there is a procedural change.
- (b) The mill's control laboratory shall be inspected by the Cement and Concrete Reference Laboratory of the National Institute of Standards and Technology on their regularly scheduled visits. The Engineer shall be provided with copies of the reports of these inspections along with an account of the action taken to correct cited deficiencies.
- (c) Records of data accumulated by the quality control procedures shall be produced upon request.

- (d) A certified document shall accompany each shipment stating that the contents conform to all applicable requirements. Additionally, the document shall show the producer's name, mill location, carrier number, date loaded, weight contained in carrier, silo number, consignee, destination, Contract number, and type of cement. The signature and title of the signer shall be shown on the document.
- (e) The mill shall, upon request, supply certified chemical and physical test values that can be associated with any sample representing cement drawn from a particular silo on a given date.
- (f) Acceptance of cement by certification will be terminated if test results differ from mill results by more than the precision limits given in the test method. The acceptance procedure shall then revert to storage testing and approval prior to shipment.

902.03 PORTLAND CEMENT. Portland cement shall conform to M 85, with the fineness and the time of setting determined in conformance with T 131 and T 153, respectively.

902.04 BLENDED HYDRAULIC CEMENT. Blended hydraulic cement shall conform to M 240, Type I (PM) or a Type IP containing 15 to 25 percent pozzolan by weight of cement. Maximum loss on ignition shall be 3.0 percent and ground iron blast furnace slag shall not be used for blending. The requirement for a manufacturer's written statement of the chemical composition is waived.

902.05 MASONRY CEMENT. Masonry cement shall conform to C 91, except the water retention and staining tests are waived.

902.06 CONCRETE ADMIXTURES. Concrete admixtures shall not contribute more than 200 ppm of chlorides based on the cement content when tested as specified in MSMT 610. Only prequalified admixtures shall be used.

A pozzolan and Type I (PM) or Type IP cement shall not be used in the same mix. Since the strength gains are delayed with these materials, a longer period of time may be required for curing and form removal.

902.06.01 Air Entraining Admixtures. Air entraining admixtures shall conform to M 154.

902.06.02 Chemical Admixtures. Chemical admixtures shall conform to M 194, Type A, D, or nonchloride C.

902.06.03 High Range Water Reducing Admixtures. High range water reducing admixtures shall be liquid and shall conform to M 194, except that the water content shall be a maximum of 85 percent of that of the control, and the durability factor shall be a minimum of 90. Type F shall be used for early strength and shall produce a minimum compressive strength in 12 hours of 180 percent of that of the control. Type G shall be used when early strength is not specified. The manufacturer shall furnish certification as specified in TC-1.02. The certification shall include curves indicating the fluid ounces of admixture per 100 lb of cement as related to water reduction and strength gain for 12 hours when used with a minimum cement factor of 700 lb.

902.06.04 Pozzolans. The Contractor may request the use of pozzolans to control alkali silica reactivity or for other reasons. When a pozzolan is used, the minimum cement factor and water/cement ratio shall be determined on the basis of the combined weight of cement and pozzolan. See Table 902 B for percentage of fly ash, ground iron blast furnace slag, and microsilica.

- (a) **Fly Ash.** Fly ash shall conform to M 295, pozzolan Class C or F, except that the maximum permissible moisture content shall be 1.0 percent, and when used in concrete Mix Nos. 3 and 6 the loss on ignition shall not exceed 3.0 percent.
- (b) **Ground Iron Blast Furnace Slag.** Ground iron blast furnace slag shall conform to M 302, Grade 100 or 120.
- (c) **Microsilica.** Microsilica shall conform to C 1240, except that the oversize requirement is waived.

902.06.05 Ground Iron Blast Furnace Slag. The Contractor may request to substitute a maximum of 50 percent of the weight of cement with ground iron blast furnace slag. When ground iron blast furnace slag is used, the minimum cement factor and water/cement ratio will be determined on the basis of the combined weight of the cement and ground iron blast furnace slag. Ground iron blast furnace slag shall conform to M 302, Grade 100 or 120.

902.06.06 Synthetic Fibers. When synthetic fibers are specified in the Contract Documents, the fibers shall be 1/2 to 1-1/2 in. long and conform to C 1116, Type III. The manufacturer shall furnish certification as specified in TC-1.02. The quantity of fibers used and their point of introduction into the mix shall conform to the fiber manufacturer's recommendations.

902.07 PORTLAND CEMENT CONCRETE CURING MATERIALS. Curing materials shall be burlap cloth, sheet materials, liquid membrane forming compounds, or cotton mats.

902.07.01 Burlap. Burlap cloth shall be made from jute or kenaf and conform to M 182, Class 1, 2, or 3.

902.07.02 Sheet Materials. Sheet material shall conform to M 171 with the following exceptions:

- (a) **White Opaque Burlap Polyethylene Sheeting.** Tensile strength and elongation requirements are waived. The sheeting shall have a finished product weight of not less than 10 oz/yd².
- (b) **White Opaque Polyethylene Backed Nonwoven Fabric.** The material shall conform to 902.07.02(a), with the thickness requirement waived. The finished product weight shall be a minimum of 5 oz/yd².
- (c) **White Opaque Polyethylene Film.** Tensile strength and elongation requirements are waived.

902.07.03 Liquid Membrane. Liquid membrane forming compounds shall conform to M 148.

Field control testing of the white pigmented curing compounds shall be on the basis of weight per gallon. The samples shall not deviate more than ± 0.3 lb/gal from the original source sample.

902.07.04 Cotton Mats. Cotton mats shall consist of a filling material of cotton bats or bats covered with unsized cloth and tufted or stitched to maintain the shape and stability of the unit under job conditions of handling.

The covering shall be either cotton cloth, burlap or jute having the following properties:

- (a) Cotton cloth covering shall weigh not less than 6.0 oz/yd² and shall have an average of not less than 32 threads/in. of warp and not less than 28 threads/in. of filling. The raw material used in the manufacture of the cotton cloth shall be raw cotton, cotton comber waste, cotton card strip waste, or combinations thereof.
- (b) Burlap or jute covering for cotton mats shall weigh not less than 6.4 oz/yd² and shall have not less than 8 threads/in. of warp and not less than 8 threads/in. of filling. It shall be the grade known commercially as "firsts" and shall be free from avoidable

imperfections in manufacture and from defects or blemishes affecting the serviceability.

The filling material for the mats shall be a cotton bat, or bats made of raw cotton, cotton waste, cotton linters, or combinations thereof, and shall weigh not less than 12 oz/yd².

902.08 FORM RELEASE COMPOUNDS. Form release compounds shall effectively prevent the bond of the concrete to the forms. The form release compounds shall not cause discoloration of the concrete or adversely affect the quality or rate of hardening at the interface of the forms.

The flash point of the form release compound shall be a minimum of 100 F when tested as specified in T 73.

902.09 PARAFFIN WAX. Paraffin wax for use as a bond breaker for concrete shall be clear. The flash point shall not be less than 380 F when tested as specified in D 92.

902.10 PORTLAND CEMENT CONCRETE. Portland cement concrete shall conform to the applicable portions of Section 915 and the following:

902.10.01 Proportioning. Prior to the start of construction, the Contractor shall submit to the Regional Engineer the source and proportions of materials to be used for each concrete mix. The mixture shall conform to 902.10.03.

The concrete, with the exception of water and chemical admixtures, shall be proportioned by weight. Water and chemical admixtures may be proportioned by volume or weight. The mix shall be uniform and workable.

902.10.02 Materials.

Coarse Aggregate	901.01
Fine Aggregate	901.01
Cement	902.03 and 902.04
Concrete Admixtures	902.06
Water	921.01

902.10.03 Portland Cement Concrete Mixtures.

The concrete mixes shall conform to the following:

TABLE

PORTLAND CEMENT				
MIX NO.	28 DAY SPECIFIED COMPRESSIVE STRENGTH	STANDARD DEVIATION	CRITICAL VALUE	MIN CEMENT FACTOR
	psi	psi	psi	lb/yd³
1	2500	375	2430	455
2	3000	450	3010	530
3	3500	525	3600	580
4	3500	525	3600	615
5	3500	525	3600	580
6	4500	675	4770	615
7	4200	630	4420	580
8	4000	600	4180	750

Note 1: When concrete is exposed to water exceeding 15 000 ppm sodium chloride content, Type II cement shall be used. In lieu of a Type II cement, a Type I cement may be used in combined form with an amount of up to 50 percent replacement with ground iron blast furnace slag, or an amount of up to 25 percent replacement with Class F fly ash. The Contractor shall submit to the Engineer the proposed mix proportions and satisfactory test results in conformance with C 1012 showing a sulfate resistance expansion not exceeding 0.10 percent at 180 days.

Note 2: The temperature of Mix No. 6 when used for other than superstructure work as defined in TC-1.02 shall be 70 ± 20 F

Note 3: When synthetic fibers are used, the slump shall not exceed 5 in.

Note 4: Nonchloride Type C admixtures may be used when approved by the Engineer.

Note 5: If a high range water reducing admixture Type F or Type G is used, the slump requirement shall be 4 to 8 in.

Note 6: Type A or D admixture shall be added to bridge, box culvert, and retaining wall concrete.

902 A

CONCRETE MIXTURES				
COARSE AGGREGATE SIZE	MAX WATER/ CEMENT RATIO	SLUMP RANGE	TOTAL AIR CONTENT	CONCRETE TEMPERATURE
M 43	by wt	in.	%	F
57, 67	0.55	2 – 5	5 – 8	70 ± 20
57, 67	0.50	2 – 5	5 – 8	70 ± 20
57, 67	0.50	2 – 5	5 – 8	70 ± 20
57, 67	0.55	4 – 8	N/A	70 ± 20
7	0.50	2 – 5	5 – 8	70 ± 20
57, 67	0.45	2 – 5	5 – 8	65 ± 15
57	0.50	1-1/2 – 3 2-1/2 max if slip-formed	5 – 8	70 ± 20
7	0.42	1 – 3	5 – 8	65 ± 15

Coarse and fine aggregate tested for alkali silica reactivity (ASR) as specified in MSMT 212 having an expansion up to 0.10 percent may be used without restriction. Those having an expansion greater than or equal to 0.35 percent shall not be used. Aggregates having an expansion greater than 0.10 but less than 0.35 percent shall be considered reactive and shall only be used when one of the following options is employed:

TABLE 902 B

OPTION	ALKALI CONTENT OF CEMENT % max	REPLACE CEMENT WITH		SPECIFICATION
		MATERIAL	% BY WEIGHT	
1	1.50	Class F Fly Ash	15 – 25	M 295
2	1.50	Ground Iron Blast Furnace Slag	25 – 50	M 302 Grade 100 or 120
3	1.50	Microsilica	5 – 7	C 1240
4	—	Blended Cement (a)	100	M 240
5	0.60 (b)	Low Alkali Cement	100	M 85

(a) Pozzolan content of 15 – 25 percent by weight of cement

(b) For mixes (Mix 6 Modified, 12 Hour Patch Mix) used for portland cement concrete pavement repairs; the maximum allowable percentage of alkalis in portland cement shall be 0.70.

When reactive aggregate is used, the Contractor shall designate which option will be used to control the formation of the ASR gel. If an option other than option 5 in Table 902 B above is chosen, the Contractor shall conduct tests as specified in MSMT 212 using the reactive aggregate and the proposed cementitious material. For approval, the expansion test results shall not be greater than 0.10 percent. When more than one reactive aggregate is used in a concrete mix, each shall be tested individually and the maximum amount of pozzolan required to reduce the expansion of all the aggregates to less than or equal to 0.10 percent shall be used. The Contractor shall submit to the Engineer the aggregate source, test results, and the percent and type of replacement cement. The Engineer may withhold source approval pending verification testing.

902.10.04 Trial Batch. A trial batch will be prepared to certify that each mix conforms to 902.10.05 and 902.10.06. Approval will be given when the test results conform to the minimum required average strength.

The Contractor shall make arrangements with the Regional Engineer, at least two weeks in advance, to have an authorized representative present during the batching and testing. Each trial batch shall consist of at least 3 yd³ of concrete. All materials, equipment, and labor required to

produce the trial batches and conduct the required tests shall be supplied at no additional cost to the Administration.

The requirement for a trial batch may be waived by the Regional Engineer when past performance records show that the required average strength requirement has been met.

902.10.05 Design Required Average Strength. The required average strength (f_{cr}') shall be the larger of:

$$f_{cr}' = f_c' + (1.34 \times S)$$

or

$$f_{cr}' = f_c' + (2.33 \times S) - 500$$

where:

f_c' = the 28 day specified compressive strength.

S = the standard deviation as specified in 902.10.06.

A test is defined as the average strength of two companion cylinders.

902.10.06 Standard Deviation.

- (a) When past performance records are available, a standard deviation shall be established from documented performance records of the producer consisting of a minimum of 15 consecutive 28 day compressive strength tests obtained within the last 12 months.

The standard deviation shall be established as the product of the calculated standard deviation and multiplier.

NUMBER OF TESTS	MULTIPLIER FOR STANDARD DEVIATION
15	1.16
20	1.08
25	1.03
30 or more	1.00

Interpolate for intermediate number of tests.

- (b) When past performance records are not available, the required average strength shall conform to the following:

SPECIFIED COMPRESSIVE STRENGTH f_c' , psi	REQUIRED AVERAGE COMPRESSIVE STRENGTH f_{cr}' , psi
Less than 3000	$f_c' + 750$
3000 – 4000	$f_c' + 1000$
4001– 5000	$f_c' + 1200$
over 5000	$f_c' + 1400$

902.10.07 Standard of Control. The average of all sets of three consecutive strength tests shall equal or exceed the critical value as specified in 902.10.03 which shall be computed using the following formula:

$$\text{Critical Value} = f_c' + (1.14 \times S) - 500$$

Failure to conform to this criteria shall be cause for immediate investigation and remedial action up to and including suspension of production. A design standard deviation equal to 15 percent of the specified strength shall be used for calculation until a minimum of 15 test results are obtained.

The actual average strength and standard deviation shall be computed upon the availability of 28 day strength data comprising a minimum of 15 tests. Should this determination indicate an excessive margin of safety, the concrete mix may be modified to produce lower average strength as approved by the Engineer. If these calculations indicate a

coefficient of variation greater than 15, the quality of the concrete and testing will be evaluated.

902.10.08 Testing. Sampling shall conform to T 141. Testing shall be performed as follows:

TEST	METHOD	MINIMUM TEST FREQUENCY
Slump	T 119	1 per 50 yd ³ (or fraction thereof)
Air Content	T 152 T 196	1 per 50 yd ³ (or fraction thereof)
Compression	T 23	1 per 50 yd ³ (or fraction thereof)
Compression Mix No. 7 Only	T 23	3 per Day

Note 1: Compressive strength tests are defined as the average of two companion cylinders.

Note 2: A second test will be made if the first slump or air content test fails. Acceptance or rejection will be based on the results of the second test.

Note 3: When constructing plain and reinforced concrete pavements, the testing frequency for slump and air content shall be 1 per 100 yd³ or fraction thereof.

902.10.09 Acceptance. Concrete will be acceptable if both of the following requirements are met:

- (a) The average of all sets of three consecutive strength tests equal or exceed the specified design strength.
- (b) No individual strength test (average of two companion cylinders) falls below the specified design strength by more than 500 psi.

902.10.10 Price Adjustment. A price adjustment will be based on the Contract unit price per cubic yard of concrete. If the unit is a lump sum item, the price per cubic yard for the concrete will be determined by dividing the cubic yards into the Contract lump sum price.

- (a) **Test Results More Than 500 psi Below The Specified Design Strength.** Failing strength tests will be considered individually with a price adjustment being applied on the percentage basis as shown below.

(Price per yd³) × (quantity of yd³ represented by the failing concrete strength) × (percent of failure).

Example:

$$\$400.00 \text{ per yd}^3 \times 50 \text{ yd}^3 \times [1 - (3600 / 4500 \text{ psi})] = \$4,000.00$$

No payment will be allowed when the test results fall below 50 percent of the specified design strength for structural concrete or 40 percent for incidental concrete.

The Engineer will determine when the strength of the concrete represented by the failing tests is sufficient to remain in place or whether it must be removed and replaced with Specification concrete.

- (b) Test Results 500 psi or less Below The Specified Design Strength.** Strength failures 500 psi or less than the specified design strength will be averaged with the next two consecutive tests. If those two tests include a failure greater than 500 psi, those tests will be evaluated as in 902.10.10(a) and replaced with the next consecutive test. If the resulting average falls below the specified design strength, a price adjustment will be applied in conformance with the table below. Any failure will only be included in one grouping.

STRENGTH BELOW THE SPECIFIED (avg of 3 tests) DESIGN LEVEL, psi	ADJUSTMENT FACTOR
MIX NO. 1 THRU MIX NO. 7	
1 – 100	0.005
101 – 200	0.01
201 – 300	0.02
301 – 400	0.04
401 – 500	0.08

Adjustment price equals (price per yd³) × (quantity of yd³ represented by the failing cylinders) × (the adjustment factor).

Example:

$$\$400.00 \text{ per yd}^3 \times 50 \text{ yd}^3 \times 0.01 = \$200.00$$

902.11 MORTAR FOR GROUT. Mortar used for grouting anchor bolts, pipe, handrail posts, and miscellaneous items shall be composed in conformance with one of the following:

- (a) One part portland cement or blended hydraulic cement and one part mortar sand by dry loose volume.
- (b) Prepared bag mixes consisting of portland cement or blended hydraulic cement and mortar sand. The prepared mixes shall produce a mortar conforming to the strength requirements specified in the Contract Documents.
- (c) Nonshrink grout shall be used when specified. The grout shall have a minimum compressive strength of 5000 psi in seven days when tested as specified in T 106, except that the cube molds shall remain intact with a top firmly attached throughout the curing period. The nonshrink grout shall have a minimum expansion of 0.0 percent after seven days when tested as specified in T 160.
- (d) Epoxy grout shall consist of sand and epoxy mixed by volume in conformance with the manufacturer's recommendations. The grout shall be capable of developing a minimum compressive strength of 6500 psi in 72 hours when tested as specified in MSMT 501. Sand for epoxy grout shall conform to 901.01.
- (e) An epoxy or polyester anchoring system may be used when approved by the Engineer in conformance with the manufacturer's recommendations. Strength values shall be as specified in the Contract Documents.

902.12 LINSEED OIL. Linseed oil shall consist of a 50-50 mixture (by volume) of boiled linseed oil conforming to Federal Specification TT-L-190 and kerosene conforming to D 3699.

902.13 LATEX MODIFIED CONCRETE. Portland cement concrete containing prequalified Laboratory approved styrene butadiene latex emulsion is defined as Latex Modified Concrete (LMC).

Latex emulsion shall have a minimum of 90 percent of the nonvolatiles as styrene butadiene polymers. The latex emulsion shall conform to Table 902.13 A. The material shall be stored in suitable containers and be protected from freezing and exposure to temperatures in excess of 85 F.

Latex modified concrete shall be proportioned using volumetric mixing and designed as follows:

LATEX MODIFIED CONCRETE	
MATERIAL	SPECIFICATION LIMITS
Portland Cement, CWT/yd ³ , min	6.6
Latex Emulsion/Cement Ratio	0.31 – 0.34
Water/Cement Ratio, max	0.22
Entrained Air, %	6.0 ± 3
Slump, in.	5 ± 1

The physical properties of LMC shall conform to Table 902.13 B. The Contractor shall also furnish the necessary 3 x 6 in. molds conforming to M 205 to be used for the fabrication of compressive strength cylinders.

Control and Acceptance Sampling.

- (a) One sample, 2 qt minimum, of the styrene butadiene latex emulsion shall be submitted to the Regional Engineer daily for each lot of material used in a day's production.
- (b) A batch for LMC is defined as the capacity of the equipment being used on the project. Slump and air samples will be taken and tested before the placement of a batch is permitted. The slump shall be measured four to five minutes after discharge from the mixer. The test material shall be deposited off the deck and not be disturbed during this waiting period. One additional sample for slump and air will be taken randomly during the placement of each batch. For seven day compressive strength, two tests each per batch are required. A test is defined as consisting of two companion cylinders. The samples for these tests will be taken at random while the placement is in progress.

TABLE 902.13 A

REQUIREMENTS FOR CHEMICAL PROPERTIES OF LATEX EMULSION MATERIALS				
PROPERTY	SPECIFICATIONS		QUALITY ASSURANCE TESTS	
	LIMITS	TOLERANCE	PREQUALIFICATION TESTS	CONTROL AND ACCEPTANCE
Color	White	—	X	X
pH	9.0 – 11.0	—	X	X
Weight, lb/gal	8.40 – 8.47	—	X	X
Solids Content, %	46 – 53	—	X	X
*Butadiene Content, % of polymer	30 – 40	—	—	—
Viscosity @ 10 rpm-cps	Match Original	± 20	X	X
*Surface Tension, dynes/cm max	50	—	—	—
*Mean Particle Size, polymer – Å	1400 – 2500	—	—	—
Coagulum, % max	0.10	—	X	X
*Freeze-Thaw Stability, coagulum, % max	0.10	—	X	X
Infrared Spectra of Latex Film	Match Original	—	X	X
Infrared of Alcohol, Soluble Portion of Latex	Match Original	—	X	X
Shelf Life, min	1 yr	—	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 612 except those denoted by an * shall be conducted as specified in FHWA RD – 78-35.

Note 2: The original or prequalification sample shall be accompanied by the producer's certification on all of the tests and properties noted above and as specified in TC-1.02. The certification shall contain actual test values of the product and the infrared spectrograph.

Note 3: A separate certification is required for each lot of material. The document shall note the date of manufacture, lot size, and whether or not the material is identical to the formulation of the original sample.

TABLE 902.13 B

LATEX MODIFIED CONCRETE PHYSICAL PROPERTIES			
TEST PROPERTY	TEST VALUES	QUALITY ASSURANCE TESTS	
		PREQUALIFIED TESTS	CONTROL AND ACCEPTANCE
7 Day Compressive Strength, psi min	3000	X	X
28 Day Compressive Strength, psi min	3500	X	—
42 Day Compressive Strength, psi min	3500	X	—
7 Day Flexural Strength, psi min	550	X	—
28 Day Flexural Strength, psi min	650	X	—
42 Day Shear Bond Strength, psi min	2000	X	—
Durability Factor, 300 cycles, % min	85	X	—
Chloride Permeability, ppm max	510	X	—
Scaling Resistance, 50 cycles, max	3	X	—

Note 1: Quality assurance tests shall be conducted as specified in MSMT 721.

Note 2: Seven Day Compressive Strength Test will be used for Control & Acceptance of the material. The strength level of 3000 psi at seven days shall be the minimum specified design strength. The mix design approval and acceptance will be based on a coefficient of variation of 10 percent with a probability of 1 in 10 tests falling below the specified strength. No test value shall fall below 80 percent of the specified strength.

902.14 RAPID HARDENING CEMENTITIOUS MATERIALS FOR CONCRETE PAVEMENT REPAIRS.

Materials shall be a dry, packaged cementitious mortar having less than 5 percent by weight of aggregate retained on the 3/8 in. sieve and shall conform to the following requirements:

Classification.

Class I — For use at ambient temperatures below 50 F.

Class II — For use at ambient temperatures of 50 – 90 F.

Class III — For use at ambient temperatures above 90 F.

Chemical Requirements. The material shall conform to the chemical requirements of C 928 and contain no organic compounds such as epoxy resins or polyesters as the principal binder.

Physical Requirements. The material shall conform to the following when tested as specified in MSMT 725:

COMPRESSIVE STRENGTH, psi min				
	< 2 hr	2-6 hr	6 hr	28 days
Type I — Slow	—	—	2000	4500
Type II — Rapid	—	2000	—	4500
Type III — Very Rapid	2500	—	—	4500

TEST RESULTS	
Bond Strength, 7 days, psi min	2000
Length Change, increase after 28 days in water, based on length at 3 hr, % max	+ 0.15
Length Change, decrease after 28 days, % max	- 0.15
Freeze Thaw, loss after 25 cycles in 10% CaCl ₂ solution, % max	8
Initial Setting Time, minutes min	10

Marking. All packages delivered to the project shall be marked with the following information:

- (a) Date material was packaged.
- (b) Approximate setting time.
- (c) Recommended dosage of water or liquid component.
- (d) Mixing instructions.
- (e) Class or temperature range.

Certification. The manufacturer shall furnish certification as specified in TC-1.02 showing the actual test results for each class and type of material submitted to the Laboratory.